Next Generation Objective Testing of Climate Models Using UV-CDAT and ESGF

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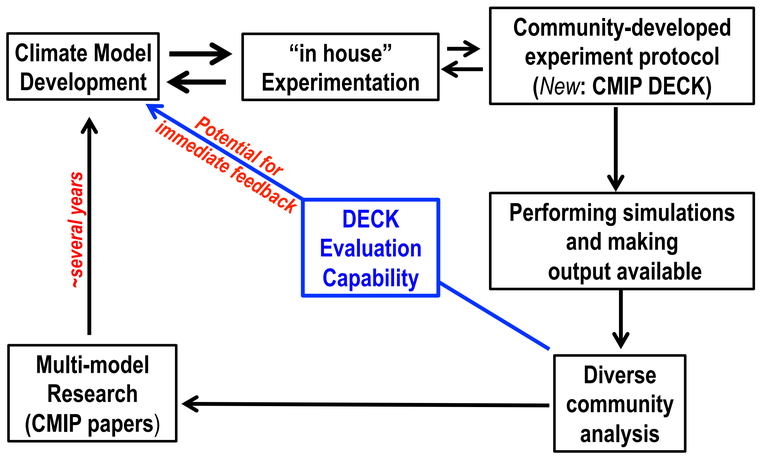
The Need and Challenge:

Benchmarking the CMIP DECK+Historical Experiments

Goal: Making CMIP summary statistics more accessible for model developers and community researchers



- As DECK simulations are published on ESGF, provide performance summaries to modeling groups and CMIP researchers
- Complement CMIP research with community-based repeat use capabilities

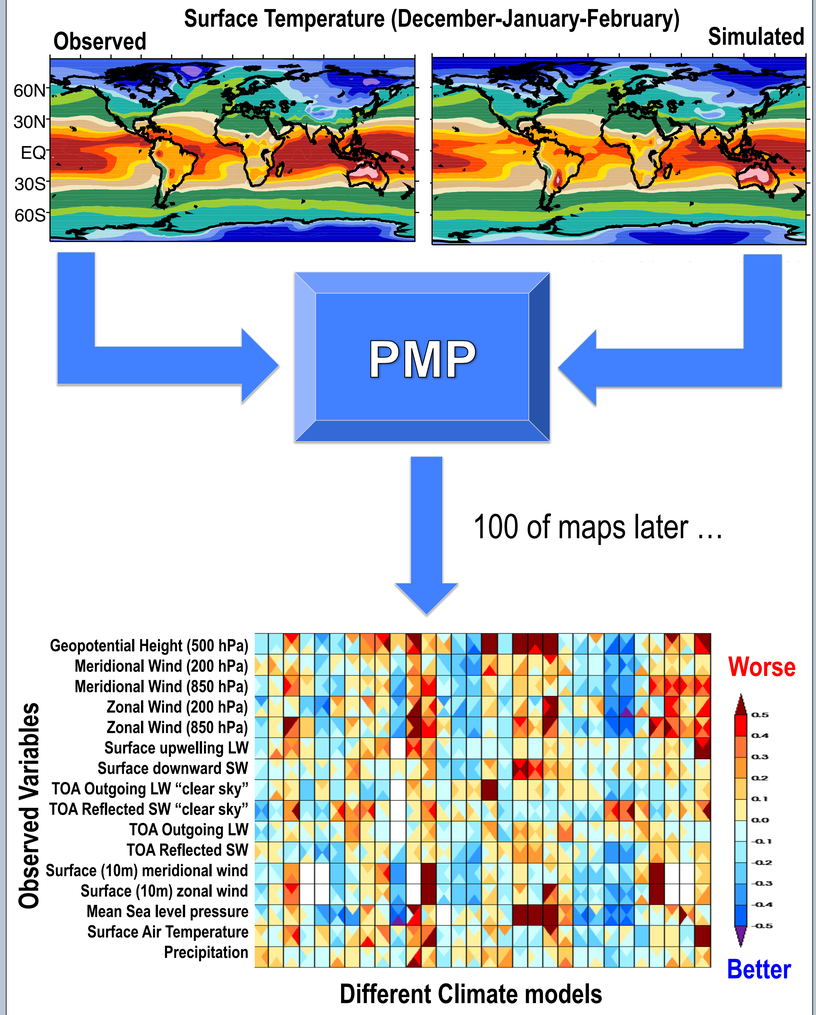
What is the DECK (Diagnosis, Evaluation and Characterization of Klima)?
A new, slowly evolving aspect of CMIP well-suited for benchmarking

Approach

- Use the data structure of the CMIP DECK as a design target to build a diverse suite of analysis capabilities
- Because most modeling groups are adopting the CMIP data structure for some internal purposes, capabilities designed for the DECK will be readily usable by modeling groups
- Build upon core UV-CDAT capabilities which are ideally-suited for CMIP multi-model analysis
- Closely linked to obs4MIPs and ana4MIPs efforts
- Open source tools managed on Github

PCMDI's Metrics Package (PMP)

Summary statistics of model comparisons with observations



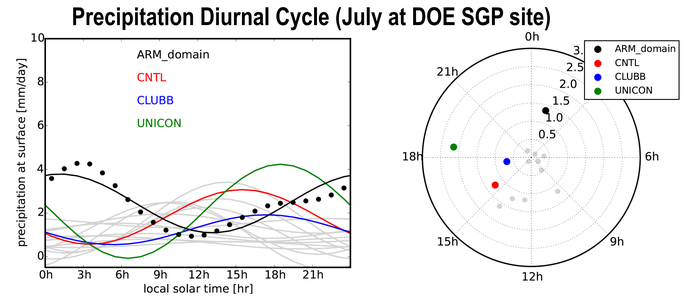
Package being expanded to include:

- Additional externally-forced tests, e.g., diurnal cycle of precipitation and onset/retreat of monsoons
- Ocean, sea-ice and selected land surface metrics
- Well-established variability statistics across a range of space and time scales, including ENSO, NAO, SAM, MJO, etc.
- Measures gauging persistent systematic biases
- Selected "Emergent constraints"

DOE's ARM Metrics

Complementing the PMP global scale perspective with analysis of local processes exploiting DOE's ARM data

- Facilitate the use of long time, high frequency observation data from multiple DOE's sites in climate model evaluation
- Provide process-oriented diagnostics to help understand model errors and develop improved physical parameterizations for climate models



Left: black dots are ARM observation. Curves are the 1st harmonics: grey for CMIP5 model AMIP type of runs. Color curves are from DOE's ACME model with different convection schemes: red for Zhang-McFarlane, blue for CLUBB and green for UNICON. Right: mapping precipitation peak time and amplitude from the 1st harmonics to polar coordinate.

Process-oriented diagnostics planned to include:

- Frequency of occurrence and intensity probability density function of clouds and precipitation
- Co-variance analysis: e.g., convection onset and transition statistics, causes of warm bias at central US
- Cloud regime analysis using ARM radar simulator output
- Diabatic heating/drying study over various cloud regimes

Looking Ahead

We envision the following:

- Establishment of a repository and guidelines for community-contributions to the PMP.
- The ARM metrics package will be fully integrated into the PMP, and also available independently
- With all model and observational and model data published in ESGF, these capabilities can be closely aligned with developments such as server side capabilities

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